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Laboratory study of sound generated gravity-capillary waves

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Excitation of gravity-capillary waves by the from-underwater-directed sound beam is investigated. Experimental configuration includes a water tank, submerged high-frequency acoustic radiator directed to the surface, surface wave generator based on subwoofer, and laser sensor system to measure free surface fluctuations. The sound beam is amplitude-modulated over typical frequency range of gravity-capillary waves. The waves driven in such way are easily controlled in their frequencies and amplitudes both at packet and continuous regime of generation. The method is characterized by frequency response function which has been derived both experimentally (starting from surface wave measurements by optical and contacts probes) and theoretically (based on equations for acoustic current velocity and surface wave propagation). Both functions match well having a local depression near surface wave speed minimum and oscillations when frequency of the waves exceeds 20 Hz.
Also, experiments on propagation of the surface wave packets driven by single sound pings of different duration and drops in free fall were carried out. In all cases phase characteristics of the propagating packets are in a good agreement regardless of the excitation method. The propagation time is determined by group velocity of the given packet.